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		First Named Inventor	Micael NILSSON
		Art Unit	1724
		Examiner Name	R. H. Spitzer
Total Number of Pages in This Submission	2*	Attorney Docket Number	514862000800

ENCLOSURES (Check all that apply)

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SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	MORRISON & FOERSTER LLP (CUSTOMER NO. 20872)		
Signature			
Printed name	Otis Littlefield		
Date	January 4, 2006	Reg. No.	48,751

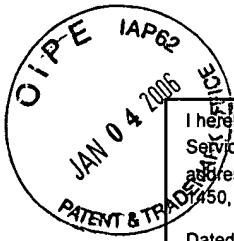
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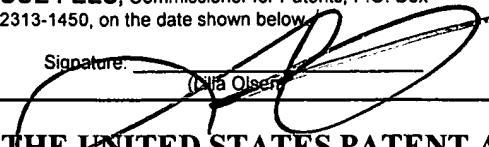
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(Ollie Olsen)

Docket No.: 514862000800
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Mikael NILSSON

Application No.: 10/664,274

Confirmation No.: 3437

Filed: September 16, 2003

Art Unit: 1724

For: SCRUBBER

Examiner: R. H. Spitzer

CLAIM FOR PRIORITY AND SUBMISSION OF DOCUMENTS

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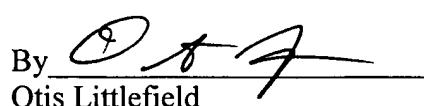
Applicant hereby claims priority under 35 U.S.C. 119 based on the following prior foreign application(s) filed in the following foreign country on the date indicated:

Country	Application No.	Date
SWEDEN	0202741-5	September 16, 2002
SWEDEN	0202905-6	October 2, 2002

In support of this claim, a certified copy of the said original foreign application is filed herewith.

Dated: January 4, 2006

Respectfully submitted,

By 
Otis Littlefield

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(71) **Sökande** Aerocrine AB, Solna SE
Applicant (s)

(21) **Patentansökningsnummer** 0202905-6
Patent application number

(86) **Ingivningsdatum** 2002-10-02
Date of filing

Stockholm, 2005-12-20

För Patent- och registreringsverket
For the Patent- and Registration Office

Hjördis Segerlund
Hjördis Segerlund

Avgift
Fee 170:-

Scrubber

The present invention relates to a scrubber for
eliminating a component from air flowing through the
5 scrubber.

Technical background

Known scrubbers comprise a housing having at least one
10 inlet hole and an outlet hole and comprising filtering
material. A scrubber may for example be used in any
equipment where for example NO-free air is needed, e.g.
for calibration, as in an equipment for measuring the
level of nitric oxide in air, especially exhalation air,
15 or any other gas mixture. In such a case a test person
inhales air through the scrubber so that NO will be
filtered from the air. The air flow may for example be
about 1-10 litre/second.

20 Preferably a return valve is positioned between the
inlet/outlet of the equipment, through which inlet/outlet
the test person inhales/exhales, and the outlet of the
scrubber so that the exhaled air does not pass the
scrubber but reaches any sensing portion of the equipment.

25 When taking a zero reference for the sensing portion of
the equipment or making a function control, a small flow
of component-free air, for example NO-free air, is used
and taken between the outlet of the scrubber and the
30 return valve. One problem with this is that the
possibility exists that the zero reference will be mixed
with a leakage back flow through the return valve. This
would compromise the accuracy of the zero measurement.

This is of course true for any filtering of a component from air. Therefore, it is an object of the present invention to provide a scrubber, which safely makes sure that the zero reference flow actually comes from the 5 scrubber and is identical to the component-free air inhaled by the test person.

Summary of the invention

10 This object is met by a scrubber according to claim 1.

An advantage with this solution is, in the case of a leakage or breakage of a return valve, the depth of the filtering material will still be large enough for 15 filtering the air, making the system safe. This also gives the advantage that the return valve may be an ordinary mechanical one suitable for large flow rates, which is less expensive, instead of an electrically controlled valve needed for handling low flow rates.

20

Another problem with known scrubbers is that the outlet is designed for large flow rates, which means that there is a large "dead space" in the outlet with air that has been stagnant in this space and the zero reference or function 25 control flow will have to go on for a long time before you may be sure that the air has flown through the scrubber.

According to an embodiment of the present invention this second outlet is smaller than the first outlet, whereby 30 the "dead space" in the second outlet is minimal forming a very effective system where less air needs to flow through the scrubber and the system in order to make sure that a zero reference has been safely registered.

Preferably the scrubber is provided for filtering NO from air.

A problem with known NO-scrubbers is that they comprise
5 carbon filters for the elimination of NO. However, these
scrubbers are not suitable for long-term use. They lose
their capability of eliminating NO quickly when exposed to
humidity even at commonly existent ambient humidity
levels. Another drawback is that they need to be
10 voluminous to be able to eliminate NO at high flows and
concentrations commonly encountered in urban environments.

Therefore it is also an object of the present invention to
provide a small scrubber, which is suitable for long-term
15 use. The solution to this is a scrubber comprising
potassium permanganate $KMnO_4$ or potassium permanganate in
combination with a suitable grade of carbon. An advantage
with this material is that it binds NO and forms manganese
dioxide. This retains its filtering capability in
20 moisturous environments, actually better than in dry
environments.

Short description of the drawings

25 The present invention will be described showing an
embodiment of a scrubber according to the present
invention together with drawings, in which:

30 Fig. 1 illustrates a cross section view of an embodiment
of a scrubber according to the present invention.

Fig. 2 illustrates the scrubber of Fig. 1 in a view
showing an end side having inlet holes.

Fig. 3 illustrates the scrubber of Fig. 1 in a perspective view.

Detailed description of a preferred embodiment

5

The scrubber of the present invention comprises a housing 1 having at least one inlet hole 2, in the shown embodiment several small inlet holes 2 spread over an end side 3, and a first outlet hole 4 in the end side 5
10 opposite the inlet end side 3. Within the housing 1 is a filtering material 6 present.

Between the housing 1 and the filtering material 6 at the inlet holes 2 and the first outlet hole 4 is a particle filter 7 present to stop particles of the filtering material 6 from leaving the scrubber through the holes 2,
15 4.

The scrubber of the shown embodiment has a cylindrical wall 8 between the two end sides 3, 5 but of course other shapes are conceivable. At the wall 8 a second outlet hole 9 is present. Also this hole 9 is protected on the inside with a particle filter 7 to stop particles of the filtering material 6 from leaving the scrubber through the
20 second hole 9. In the shown embodiment the air flowing through the filtering material 6 from the inlet holes 2 to the second outlet 9 passes via a channel 10.

The first outlet hole 4 is designed for a throughput of
30 about 1-10 litres/second of air and the second outlet hole 9 is designed for a throughput of about 0,5-50 millilitres/second, preferably.

In order to make sure that the air leaving the second outlet hole 9 has passed a sufficient depth of the filtering material 6, there are not any inlet holes 2 in the inlet end side 3 in the vicinity of the second outlet hole 9. In such way the air must travel a depth in the filtering material 6, for example at least corresponding substantially to the depth for the air to travel between the inlet holes 2 and the first outlet hole 4, making sure that the component, for example NO, will be filtered from the air.

In order to make the air flow from the inlet holes 2 to the second outlet hole 9 and not from the first outlet hole 4 to the second outlet hole 9 a return valve 11 may be arranged in the first outlet hole 4 or outside in the extension of the outlet hole 4.

As a safety measure, in case of leakage in the return valve 11, the second outlet 9 should be provided at a distance from the first outlet valve 4 also. Thus the air must travel a depth in the filtering material 6 at least corresponding substantially to depth for the air to travel between the inlet holes 2 and the first outlet hole 4, making sure that the component, for example NO, will be filtered from the air.

The filtering material 6 is preferably potassium permanganate $KMnO_4$ or potassium permanganate in combination with a suitable grade of carbon in granular form if the component to be removed is NO. The granules may have the size 1/8-1/128 of an inch and preferably 1/32-1/64 of an inch. Preferably the air leaving the scrubber from any of the outlet holes 4, 9 has a content of NO less than 5 ppb, in general in urban environments.

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The present invention is not limited to the shown and described embodiments but can be varied and amended within the scope of the attached claims.

Claims

1. A scrubber for eliminating a component from air
5 flowing through the scrubber, comprising a housing
(1) having at least one inlet hole (2) and an outlet
hole (4) and which is comprising filtering material
(6), **characterised in that** a second outlet hole (9)
is provided in the housing (1) at a position situated
10 at a distance from the first outlet hole (4) and any
inlet hole (2) so that the air leaving the second
outlet hole (9) will have passed at least through a
depth of the filtering material (6) substantially
corresponding to the depth of the filtering material
15 (6) for the air flowing from the inlet hole (2) to
the first outlet hole (4).
2. A scrubber according to claim 1, wherein the second
outlet hole (9) is intended for a smaller throughput
20 of air than the first outlet hole (4).
3. A scrubber according to claim 1 or 2, wherein several
inlet holes (2) are provided in the housing (1) in an
end side (3) opposite an end side (5) comprising the
first outlet hole (4).
25
4. A scrubber according to claim 1, 2 or 3, wherein the
second outlet hole (9) is provided at the wall (8) of
the housing (1) between the two end sides (3, 5).
30
5. A scrubber according to any one of the previous
claims, wherein no inlet holes are present in the end
side (5) comprising the first outlet hole (4) in the
vicinity of the second outlet hole (9) so that the

air will flow at least through a depth of the filtering material substantially corresponding to the depth of the filtering material (6) for the air flowing through the first outlet hole (4).

5

6. A scrubber according to any one of the previous claims, wherein a non-return valve (11) is provided in the first outlet hole (4).

10

7. A scrubber according to any one of the previous claims, wherein the scrubber is provided for filtering NO.

15

8. A scrubber according to claim 7, wherein the filter material (6) is potassium permanganate KMnO₄ or potassium permanganate in combination with a suitable grade of carbon.

20

9. A scrubber according to claim 7 or 8, wherein the scrubber eliminates NO to a level less than 5 ppb.

25

10. A scrubber according to any one of the previous claims, wherein a particle filter (7) is provided inside the housing (1) at least at the inlet holes (2) and at the first and second outlet holes (4, 9) in order to stop the filter material (6) to escape from the scrubber.

30

11. A scrubber according to any one of the previous claims, wherein the flow rate through the first outlet hole (4) is about 1-10 l/s and the flow rate through the second outlet hole (9) is about 0,5-50 ml/s.

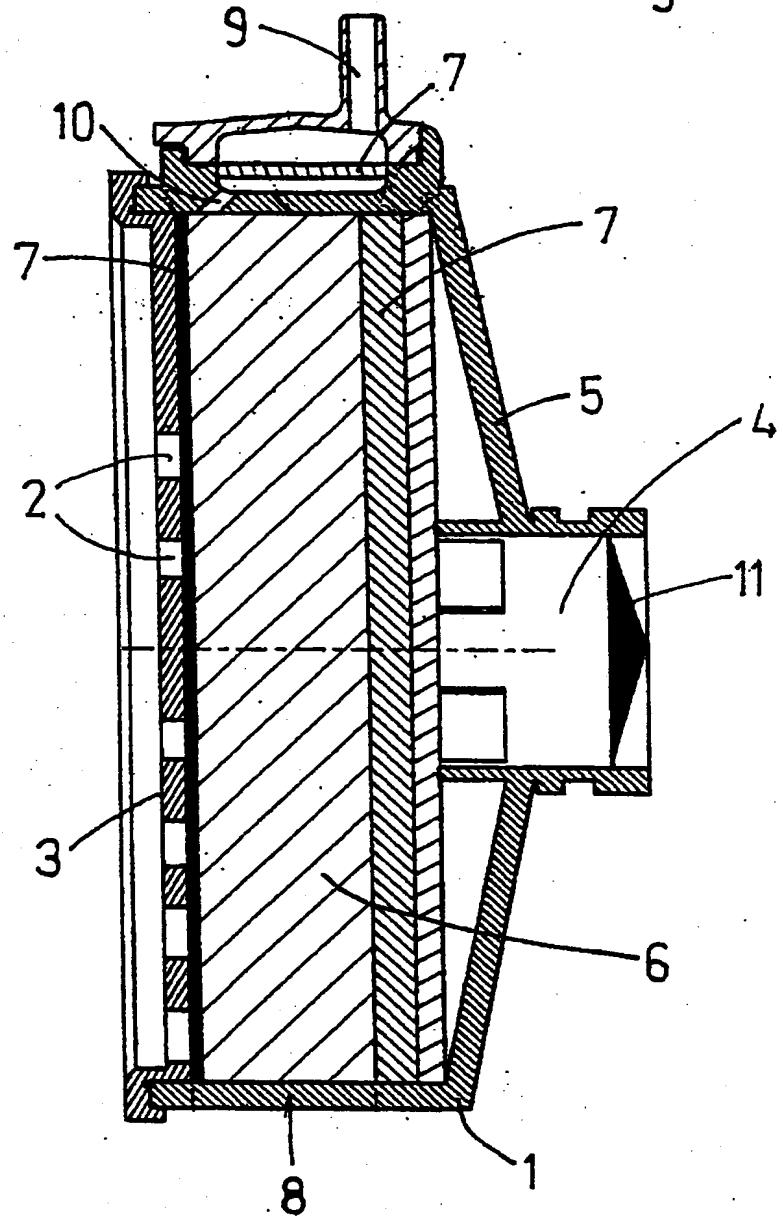
12. A scrubber according to any one of the previous claims, wherein the size of the particles of the filtering material is in the range of 1/8-1/128 of an inch and preferably 1/32-1/64 of an inch.

Abstract

A scrubber for eliminating NO from air flowing through
5. the scrubber, comprising a housing (1) having at least
one inlet hole (2) and an outlet hole (4) and which is
comprising filtering material (6). A second outlet hole
(9) is provided in the housing (1) at a position
situated at a distance from the first outlet hole (4)
10 and any inlet hole (2) so that the air leaving the
second outlet hole (9) will have flown at least through
a depth of the filtering material (6) substantially
corresponding to the depth of the filtering material (6)
for the air flowing from the inlet hole (2) to the first
15 outlet hole (4).

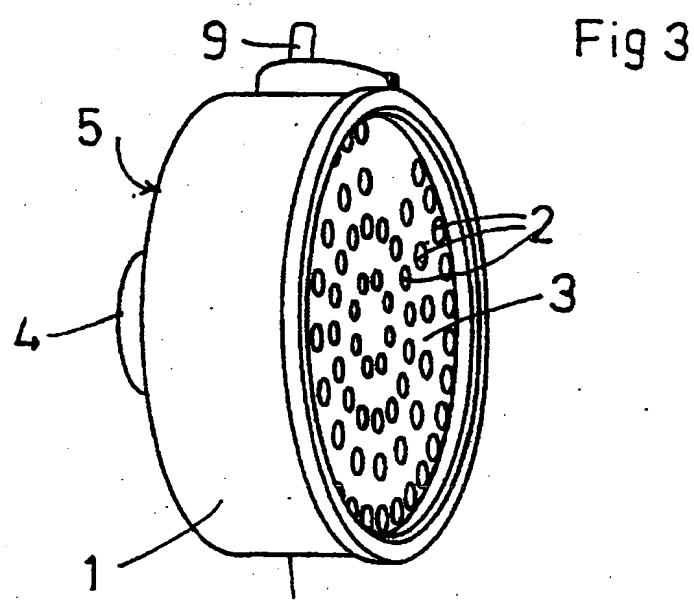
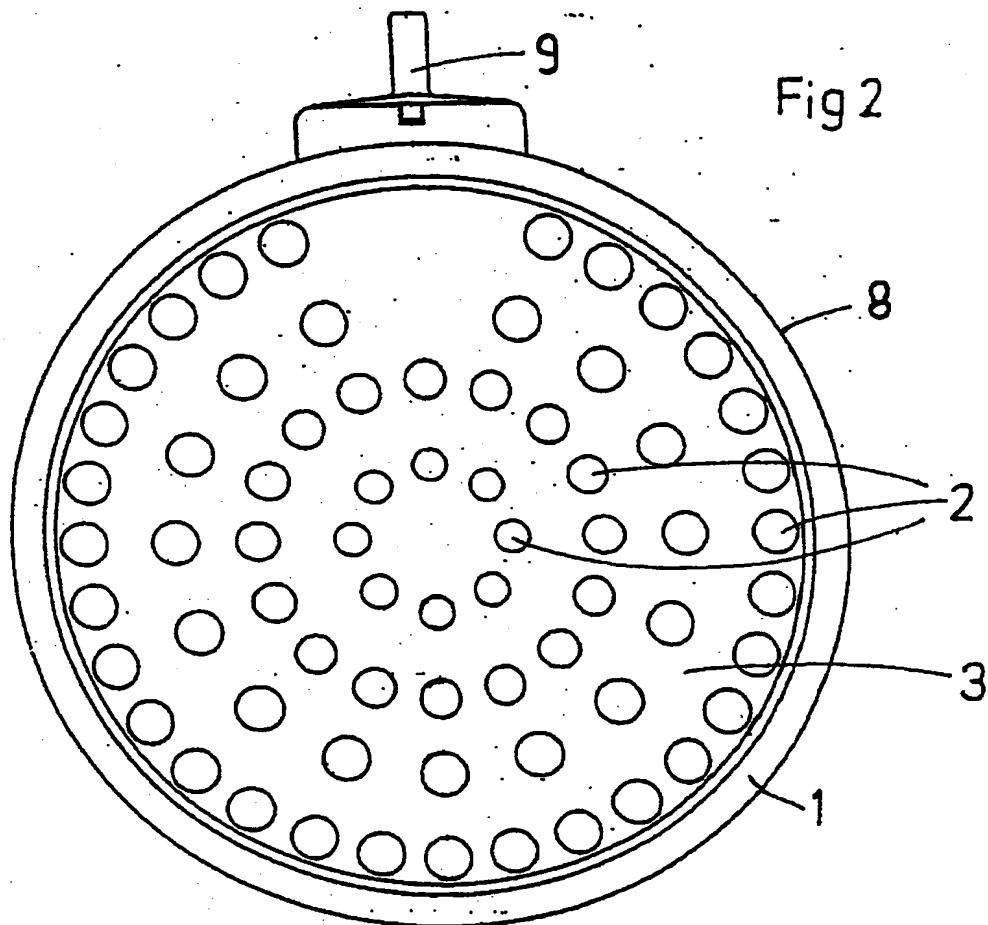
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Fig 1



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